

THE NATIONAL ENERGY EFFICIENCY AWARDS 2007

Energy Efficient Products Category

PROJECT TITLE:

Energy savings gained from applying Advanced Aeration to waste-water treatment

ADVANCED
AERATION 



INTRODUCTION

Advanced-Aeration has been successfully demonstrated to dramatically improve energy efficiencies within wastewater treatment. This research established very exceptional results from systems installed for Anglian Water. Advanced-Aeration was developed by Bio-Bubble Ltd and has a remarkable ability to significantly improve overall energy efficiencies and the carbon footprint of waste water treatment whilst producing a stable high quality effluent that can be recovered and reused, usually without the preliminaries required by other treatment systems.

THE ENVIRONMENTAL ATTRIBUTES OF THIS BRITISH INNOVATION INCLUDE

- a) An exceptionally lower sludge waste production that is lower than any other system and which significantly reduces the energy requirement of further treatment and transportation, the sludge is also highly stable and less volatile in comparison to other processes and, unlike other processes, requires very minimal treatment and energy input to meet conditions for agricultural disposal.
- b) A proven exceedingly reliable and stable quality of effluent that can meet highly sensitive environmental discharge requirements but with lower energy input than other processes. Typically, the energy used is comparable to systems treating effluent to far less stringent quality discharges, the process has also demonstrated a very high resistance to shock polluting loads or unforeseen increased loads entering the plant without deterioration in the quality of discharge.
- c) Advanced-Aeration also has the ability to treat waste water from municipal or industrial discharges without producing obnoxious odours commonly noticeable with other processes. Odours are treated naturally within the process without the requirement for further energy waste through ancillary odour treatment plant. Advanced-Aeration again, has a proven ability to treat effluent at full load on the hottest summer day without obnoxious odours in evidence.
- d) The process requires no chemical additives to treat the wastewater or to thicken sludge; this is quite commonly a prerequisite for other systems. The energy input of chemical production, supply and transportation, plus the additional handling plant for chemical application are therefore eliminated.

The aim of the project was to evaluate the extent of energy savings being realized at installations within the Anglian Water utility area and, from January 2005, all nine plants that until then had been operating for 18 months or over were selected. The selected plants varied in size from small to medium size works, ranging from a system serving a small hamlet of 75 persons, to a plant serving up to 15,000 population equivalent.

All the systems were treating the wastewater to a fully nitrifying higher quality than required; however, the power usage and sludge waste production of a conventional activated sludge process operating to produce a lower quality 20 BOD: 30 SS effluent was used as a reference.

Statistics of sludge waste produced from the old plants that were replaced was also included within the evaluation although the power usage of these systems was not available. Assistance and access to the sites along with information of sludge waste disposal, costs of power usage and sludge disposal was kindly supplied by Anglian Water.

DIRECT BENEFITS

Analysis of accumulated information demonstrated the true benefits of applying Advanced-Aeration to treat waste water within a municipal domain. On average, power costs savings between all the selected plants was 26% per year with a maximum saving of 42% per year. This equates to £ 4,726.00 on average and £ 20,075.00 cost saving between the selected works on power expenditure alone.

This detail must be put into context of the relatively small to medium size of the works. Equivalent savings can also be applied in proportion to larger municipal applications. Moreover, there are tens of thousands municipal waste water treatment works within the UK, therefore, the order of magnitude for reducing costs and power usage is absolutely immense.

A further direct benefit is the reduction of the overall carbon footprint. An average reduction in carbon footprint of 34% was realised with a maximum of 43% between the selected plants equating to 53 and 195 tonnes respectively. Evaluation of the carbon footprint was restricted to the power costs for biological treatment only and transporting the sludge waste to a reception centre located an arbitrary 30 miles away from the selected works. This was to emulate a like-for-like approach to achieve impartiality between the different processes.

Additional considerations required for conventional treatment systems such as clarification tanks and odour control, or sludge thickening was not taken into account. It should be stated that if all ancillary plant were included, the disparity between power and carbon emissions would increase in favour of Advanced-Aeration.

INDIRECT BENEFITS

Sludge waste production was reduced on average by 73% with a maximum of 88% reduction between the selected plants equating to annual cost savings of £59,177.00 and £164,225.00 respectively. Again, this must be put into context of the relatively small to medium size of the works. Further energy savings can be attained by adopting the correct procedures for sludge removal, which will significantly reduce the quantity of sludge export and lower both energy and carbon emissions. Earlier records of the selected plants demonstrate this where sludge waste production was lower on average at 88% with a maximum of 97% reduction.

The natural sludge treatment qualities of Advanced-Aeration ensure lower quantities of sludge are produced to pass on for further treatment and will also significantly reduce the energy input and carbon emissions entailed by supplementary treatment and transportation. The greater quantity of sludge treatment and reduction within Advanced-Aeration is completed using the same source energy for effluent treatment, which is analogous to conventional treatment systems that provide treatment to the effluent only and to a lower quality effluent discharge.

All Advanced-Aeration systems provide a fully nitrified effluent. This will impose far less impact on to the receiving environment than the lower qualities normally applied to the majority of mainland or coastal discharges. Higher qualities can also be applied to achieve full nutrient removal without excessive increase in power or carbon emissions

ENERGY SAVINGS DETERMINED AS A RESULT OF THE PROJECT	
Average Power Reduction	26%
Maximum Power Reduction	42%
Average Carbon Emission Reduction	33%
Maximum Carbon Emission Reduction	43%